

Sigma Xi, The Scientific Research Society

Review

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Source: *American Scientist*, Vol. 70, No. 6 (November–December 1982), pp. 638–639

Published by: [Sigma Xi, The Scientific Research Society](#)

Stable URL: <http://www.jstor.org/stable/27851745>

Accessed: 03-01-2016 20:26 UTC

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are interested in the origins of modern biochemistry. The writing is occasionally uneven, which may be the result of problems in editing. However, I am impressed by this honest attempt of a fundamentally modest man to give an account of what motivated him, of the environment in which he developed his gifts, and of his methods of work. No doubt later historians of science will evaluate his work, but we are fortunate to have this firsthand account by one to whom we are so much indebted.—*Hermann Blaschko, Pharmacology, Oxford University*

Physical Sciences

Pointlike Structures Inside and Outside Hadrons. Antonino Zichichi, ed. The Subnuclear Series, 17. 739 pp. Plenum, 1982. \$85.

Pointlike objects have often been chosen to represent the “elementary structures” of which matter is composed. For present experimental physics, the relevant pointlike structures are the quarks and leptons. Ordinary matter is composed of the *u* and *d* quarks, each having three “colors,” and the electron *e* and its neutrino ν_e . The proton and neutron are bound states of quarks—*uud* and *udd*, respectively—each in a color-neutral state. This set of objects (*u*, *d*; ν_e) comprises the first generation of quarks and leptons. Nature poses one of the central questions of present high energy physics by providing analogous sets of objects which seem to be higher-mass copies of the first generation. The second generation is complete and consists of the charm *c* and strange *s* quarks and the muon μ and its neutrino ν_μ . The third generation lacks only the *t* quark, the analog of the *u* quark, and can be summarized as (*t*, *b*; ν_τ , τ). The interactions of these pointlike objects are described by local gauge theories. The strong interactions associated with quarks are described by the gauge theory of color, quantum chromodynamics (QCD); the electromagnetic and weak interactions associated with both quarks and leptons are described by the partially unified electroweak gauge theory of flavor.

The conference at Erice, Sicily, in 1979, on which this volume is based, was primarily concerned with the physics, both theoretical and experimental, of QCD and the electroweak gauge theory. Readers can get the flavor of the controversy over the relation between experimental data and QCD from a lengthy debate about the experimental status of QCD conducted by five CERN theorists, although uninitiated readers may miss some of the humor, which is best appreciated by those knowing the personalities of the protagonists. Coherent expositions of aspects

of QCD ranging from the $1/N$ approximation to the search for exotic quark model states are given in four sets of theoretical lectures. The then-latest experimental data on inelastic lepton-hadron interactions and electron-positron interactions are given in four sets of review lectures, which include introductions to the theory relevant to the analysis of the experiments. Charming opening and closing lectures by Weiskopf and Casimir are included.

The present focus of theoretical research in high energy physics has gone beyond QCD and the electroweak theory to grand unification models which unify the strong and electroweak interactions (and in some cases also gravity) to supersymmetric versions of the grand unified models, in which bosons and fermions are unified into supermultiplets, and models which assume that the pointlike quarks and leptons of the present volume are in fact composite. The volume under review is a good summary of pre-grand unified physics, in which quarks and leptons were thought to be the ultimate pointlike objects.—*O. W. Greenberg, Physics, University of Maryland*

Quantum Mechanics. Hendrik F. Ham-eka. 387 pp. Wiley-Interscience, 1981. \$32.50.

This book is meant as an introductory text in quantum mechanics for undergraduate physics and chemistry majors. Starting slowly with a historical discussion of the development of the concept of quantization, the author presents the standard material of nonrelativistic wave mechanics and applies it to the description of atomic systems. He gets as far as the quantization of the normal modes of the radiation field. The most novel feature of his presentation is the chapter on perturbation theory, where, owing to the author's special expertise, a more wide-ranging treatment than usual is given.

The style is expansive and makes for easy reading. The author presupposes almost no sophistication in mathematics beyond elementary differentiation and integration. One result of this approach is that much of the material emerges surrounded by, for me at least, almost agonizing manipulative algebraic detail. Hidden by all this are the beauty and simplicity of the underlying structure of quantum mechanics itself, which is nowhere brought to light or even so much as hinted at.—*Charles M. Sommerfield, Physics, Yale University*

Quantum Mechanics in Mathematics, Chemistry, and Physics. Karl E. Gustafson and William P. Reinhardt, eds. 506 pp. Plenum, 1981. \$59.50.

Many fundamental problems in quantum mechanics are of common in-

terest to chemists, physicists, and mathematicians; for instance, spectral properties of Schrödinger operators, scattering theory, properties of eigenfunctions, and so on. Naturally the detailed questions, methods, and motivations are quite different, but there is recently a common feeling that it is profitable to talk with each other. For that reason, activities that stress the interdisciplinary nature of quantum mechanics should be welcome.

This book grew from a “Special Session in Mathematical Physics,” organized as a part of the meeting of the American Mathematical Society in Boulder in 1980. It consists of 37 talks given by mathematicians, physicists, and chemists. About 80% of the articles are related to quantum mechanics. The subjects include rigorous results on scattering theory, the relation between quantum mechanics and classical mechanics, dilation analyticity, and many other topics of current interest in quantum mechanics.

A number of distinguished authors present interesting new results on rigorous aspects of quantum scattering (Enns and Simon, Sigal, Devinatz and Rejto, to mention a few). These talks and some others—those, for instance, on the Stark effect (Herbst) and on the classical limit of the number of quantum states (Lavine)—document very well some recent developments in rigorous quantum mechanics.

There are some interesting survey articles on semiclassical problems by “chemists” (though in this field it may soon be no longer adequate to distinguish between chemists, physicists, and mathematicians). These contributions (Heller and co-workers, Noid and co-workers, Reinhardt and Jaffé, Tabor, Shirts and Reinhardt) illustrate very well the conceptual difficulties that arise by relating classical pictures (trajectories and the like) to quantum problems. For a better understanding of various phenomena in atomic and molecular physics, such new developments (still nonrigorous and speculative) are certainly necessary. Although, for my taste, the topics are too scattered, this book might help to reduce the language barriers between mathematicians, physicists, and chemists working on quantum problems.—*Thomas Hoffmann-Ostenhof, Theoretical Chemistry, University of Vienna*

Basic Quantum Mechanics. J. L. Martin. Oxford Physics Series, 8. 241 pp. Oxford University Press, 1981. \$39.50 cloth, \$17.95 paper.

Quantum Mechanics. Alastair I. M. Rae. 237 pp. Halsted Press, 1981. \$24.95 paper.

There are so many introductory texts in quantum mechanics that one almost has to attempt a taxonomy. If one does so,

the type species of these two books would be *Matthews (Introduction to Quantum Mechanics, McGraw-Hill, 2nd ed., 1968)*, which is terse, short, very clearly written, and has fewer problems and fewer drawings than a comparable American text. It sticks to the outlines of the theory and leaves applications aside.

Rae follows the pattern that is typical of such books: after an introduction to general principles, each new topic is introduced by a simple example and is then given a general mathematical treatment. The discussions are rather formal and do not move far toward showing how the theory confronts experimental data. *Rae* is unusually sensitive to the conceptual problems of quantum mechanics and contains an entire last chapter devoted to a good discussion of Einstein-Podolsky-Rosen matters. On the other hand, *Rae* seems curiously insensitive to the existence of the principle of superposition. There is no mention of it in the index. It is taken for granted in discussing diffraction of matter waves, and *Rae* never points out how remarkable it is to find such a principle in a theory of matter. In a discussion on p. 40, he ignores it and draws conclusions that I think are quite wrong.

Martin is a more original and interesting book and in my opinion a better one. It starts (as does *Dirac*) with the quantum mechanics of photon polarization and carefully derives the principles that *Rae* expresses as postulates. It covers a wider range: hyperfine structure, interaction representation, LCAO, van der Waals forces, in addition to the usual topics. For some unfathomable reason, at vast inconvenience to the reader, the figures are not captioned and the equations are not numbered, so that it takes a careful search to find out which chapter something is in. But this is a thoughtful and interesting text, a worthy successor to *Matthews*.—*David Park, Physics, Williams College*

Gauge Theories in Particle Physics: A Practical Introduction. Ian J. R. Aitchison and Anthony J. G. Hey. 341 pp. Bristol, UK: Adam Hilger, 1982. \$36 paper.

This book treats gauge theories at the first- or second-year graduate level. The emphasis is on phenomenology and on a broad overview of how gauge theories work, rather than on the deeper mathematical and conceptual aspects.

Taken for what it is, the book succeeds rather well. It is clearly written, and attention is paid to making it pedagogically effective. Each chapter is equipped with a summary and a set of problems, although these are too often of the "verify equation (10.26)" variety. I especially liked Chapter 9, which presents material unusual in a particle physics text, an explanation of spontaneous symmetry

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